

CLAIMS

A 1. A hub apparatus for a millimeter wave wireless communication system, comprising:

a support member;

5 a fan beam antenna coupled to said support member that propagates electromagnetic energy in a fan pattern; and

a receive antenna mechanism coupled to said support member that receives a plurality of pencil beam  
10 transmissions from different customer premises equipment (CPEs) located in different physical locations within the range of the radiation pattern of said fan antenna.

2. The apparatus of claim 1, wherein said fan beam  
15 antenna mechanism propagates an electro-magnetic radiation pattern that has an azimuth component that is greater than its elevation component.

3. The apparatus of claim 1, wherein said fan  
20 antenna propagates millimeter wave electro-magnetic energy.

4. The apparatus of claim 1, wherein said receive  
25 antenna mechanism includes a shared aperture antenna device.

5. The apparatus of claim 4, wherein said shared aperture antenna device is a phased array antenna device.

30 6. The apparatus of claim 4, wherein said shared aperture antenna device is a multi-beam antenna device and has a plurality of individual feeds provided

therewith, each feed propagating a pencil beam transmission from a different physical location.

7. The apparatus of claim 4, wherein said shared aperture antenna device includes a Luneberg lens.

8. The apparatus of claim 1, wherein said receive antenna mechanism is an array of pencil beam receive antennas.

9. The apparatus of claim 1, wherein at least one of said fan beam antenna and said receive antenna mechanism is configured to function in 360 degrees in azimuth.

10. The apparatus of claim 1, further comprising a supplemental pencil beam antenna coupled to said support member and separate from said receive antenna mechanism that is capable of transmitting electro-magnetic energy beyond the range of said fan antenna, such that at a given distance from said hub, the signal propagated from said supplemental pencil beam antenna has a greater signal strength than a signal propagated from said fan antenna.

11. The apparatus of claim 1, wherein said receive antenna mechanism includes a plurality of receive signal processing channels that each have a first mixer for separation of a first set of IF signals, and wherein each of said mixers is coupled to a common LO signal generator.

A 12. A hub apparatus for a millimeter wave wireless communication system, comprising:

a support member;

5 a transmission antenna coupled to said support member that propagates electromagnetic energy in a pattern that has an azimuth component that is larger than the elevation component; and

a receive antenna mechanism coupled to said support member that receives a plurality of pencil beam transmissions from different customer premises equipment (CPEs) located in different physical locations within the range of the radiation pattern of said transmission antenna.

15 13. A hub apparatus for a millimeter wave wireless communication system, comprising:

a support member;

20 a hub-based transmit antenna coupled to said support member that propagates electromagnetic energy to a plurality of customer premises equipment (CPEs) within the range illuminated by said transmit antenna; and

a hub-based receive antenna mechanism coupled to said support member that receives a plurality of pencil beam transmissions from different CPEs located in 25 different physical locations within the range of the transmit antenna, said receive antenna mechanism including a shared aperture antenna device.

30 14. The apparatus of claim 13, wherein said transmit antenna includes a shared aperture antenna device.

A 15. The apparatus of claim 14, wherein the shared aperture transmit antenna device and the shared aperture receive antenna device utilize at least in part a common shared aperture device; and

5 said hub apparatus further includes circuitry for processing separate receive and transmit signals from and to, respectively, that common shared aperture device.

16. The apparatus of claim 14, wherein said shared 10 aperture transmit antenna device includes a phased array antenna device.

17. The apparatus of claim 14, wherein said shared 15 aperture transmit antenna device includes a multi-beam antenna device.

18. The apparatus of claim 13, wherein said transmit antenna includes a fan antenna device.

20 19. A millimeter wave wireless communication system, comprising:

a hub support structure;

a hub-based transmit antenna coupled to said support structure for transmitting electro-magnetic energy;

25 a plurality of customer premises equipment (CPEs) capable of receiving electro-magnetic radiation from said hub-based antenna, and each CPE including a pencil beam antenna for transmitting electro-magnetic energy towards said hub support structure; and

30 a receive antenna mechanism coupled to said hub support structure that receives pencil beam electro-magnetic energy from each of said plurality of CPEs.

A 20. The system of claim 19, wherein the pencil beam antenna of each CPE is used for transmit and receive.

21. The system of claim 20, wherein said transmit  
5 antenna and said receive antenna mechanism are configured to propagate millimeter wave electro-magnetic energy.

22. The system of claim 19, wherein said hub-based  
10 receive antenna mechanism includes a shared aperture antenna device.

23. The system of claim 19, wherein said hub-based  
15 transmit antenna includes a shared aperture antenna device.

24. The system of claim 19, wherein said hub-based receive antenna mechanism includes an array of pencil beam receive antennas.